6 CYANOACRYLATE ESTER FUMING

6.1 INTRODUCTION

Cyanoacrylate esters are the active ingredients in the super bond adhesives and are generally available according to the type of alcohols used in manufacturing. Most cyanoacrylates are methyl or ethyl esters. Regardless of type, the esters volatilize into long chain molecules with a positive electrical charge. In an atmosphere of relatively high humidity, the cyanoacrylate ester molecules are attracted to fingerprint residue and polymerize upon the deposit.

Properties of the polymer are dependent upon the type of cyanoacrylate ester used. Both ethyl and methyl esters produce a visible white coating. Ethyl ester polymers are softer and less durable while methyl ester polymers can usually only be removed with solvents. However, the durable, hard property of the methyl ester appears to inhibit dye applications.

Locktite and other brand name products contain a cyanoacrylate ethyl ester and have proven to be quite effective for fuming. Locktite 495 Super Bonder provides a liquid useful for heat acceleration techniques while Hard Evidence is a gel which reacts to exposure to air. Any product containing ethyl ester generally will be more effective when subsequent laser dye applications are indicated. Cyanoacrylate ester fuming is highly effective with nonporous items made of plastics or metal. It is superior to any other method for the processing of gun metal.

6.2 PREPARATIONS

No specific preparations are needed as the cyanoacrylate materials being used are commercially prepared.

6.3 INSTRUMENTATION

Cyanoacrylate Fuming Chambers, Atmospheric and Vacuum

6.4 MINIMUM STANDARDS & CONTROLS

The Standards and Controls for cyanoacrylate ester fuming procedure requires the use of test impressions. Aluminum foil and film leaders are convenient substrates when deliberately deposited with a test impression and placed near the evidence. Processing should be terminated when test impressions have reached optimum development. However, all items should be watched carefully as faster or slower development may occur. Exposure of surfaces to a high concentration of fumes can result in overdevelopment which obscures impressions due to total surface polymerization. Test impressions must be done with each batch of items processed. Documentation of the test impressions must be done in the examiner's work notes.

6.5 ATMOSPHERIC CHAMBER

Volatilization of cyanoacrylate ester at normal room temperature is relatively slow but is a viable procedure for evidence processing. Vapors must be contained, and a tank or plastic enclosure is most often used. A ratio of two drops of adhesive for every gallon of capacity or volume with relatively high humidity is usually effective. Polymerization may be retarded or prevented by low humidity. The addition of a cup of lukewarm water usually will improve the fuming results. Development time will vary with the temperature, humidity and the substrate being processed.

Application of heat greatly accelerates volatilization. Metal blocks or a hot plate can serve as the heat source but caution must be used not to over heat to the point where cyanide vapors can be produced. An aluminum dish or shaped foil may be placed on the hot surface and the adhesive poured onto the aluminum. A cup of warm water is placed in the enclosure. Volatilization can be very rapid and development may be accomplished. Care must be taken to closely observe the process to insure that the item is not overdeveloped.

An alternative, which offers rapid development time with minimum health risk, is to use a light bulb as the heat source. A standard light receptacle is added to the processing tank with a wire loop support fashioned to hold a watch glass approximately 1-inch above the light bulb. The adhesive is dropped onto the watch glass. A cup of warm water is placed in the enclosure if additional humidity is needed. Once the container is covered tightly, the light is turned on. Rapid

volatilization does not begin until the heat from the bulb penetrates the watch glass. Natural convection currents aid dispersal of the fumes and development is generally accomplished in about 15 minutes.

A convenient and effective method is the use of an exclusive product, Locktite Hard Evidence. Cyanoacrylate esters are mixed in a gel with chemicals that produce fairly rapid but controlled volatilization upon exposure to air. The product is available in pouches which are easily peeled open to commence the volatilization, but which can be resealed to stop the reaction. Each pouch will produce fumes for ten to fifteen hours dependent upon ambient temperature; however, volatilization slows with exposure so that more time must be allowed for pouches approaching exhaustion. Hard Evidence does have a shorter shelf life than liquid cyanoacrylate ester compounds. Pouches anticipated to be stored for longer than six months should be refrigerated but not frozen, and allowed to reach room temperature before use. However, previously opened pouches should not be refrigerated. Opened pouches which may not be used again for some time should additionally be sealed with tape to prevent gradual release of fumes.

6.6 VACUUM CHAMBER

A vacuum chamber using humidity and cyanoacrylate vapors @37°C is a highly sensitive system to develop fingerprints on the inside of polyethylene bags, hand guns, long guns, gas cans, etc. Vacuum chambers are particularly effective on evidence that has a soot or oil film on the surface. Incubating dry fingerprints prior to CA fuming enhances the ridge detail.

6.7 INTERPRETATION OF RESULTS

Photographic preservation of all suitable polymerized impressions is recommended prior to any additional processing. Once the latent impressions are recorded, further processing sometimes reveals impressions in which polymerization was too indistinct for visual notice or did not occur. Powders and particulate developers are effective and often permit additional photographic and lifting preservation. Small particle reagent will sometimes adhere to faint impressions when powders will not. Laser dye application is generally effective after powder, particulate, or SPR application as the liquid dye solution will normally wash away the particulate remnants. However, vinyl, rubber, oily guns, and hard plastics, especially those used in cash register drawers, may not be receptive to any powder.

6.8 REFERENCES

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